< **Supplementary Information**>

Serum gamma-glutamyl transferase and diabetes risk in the general Korean population: a Mendelian randomization study

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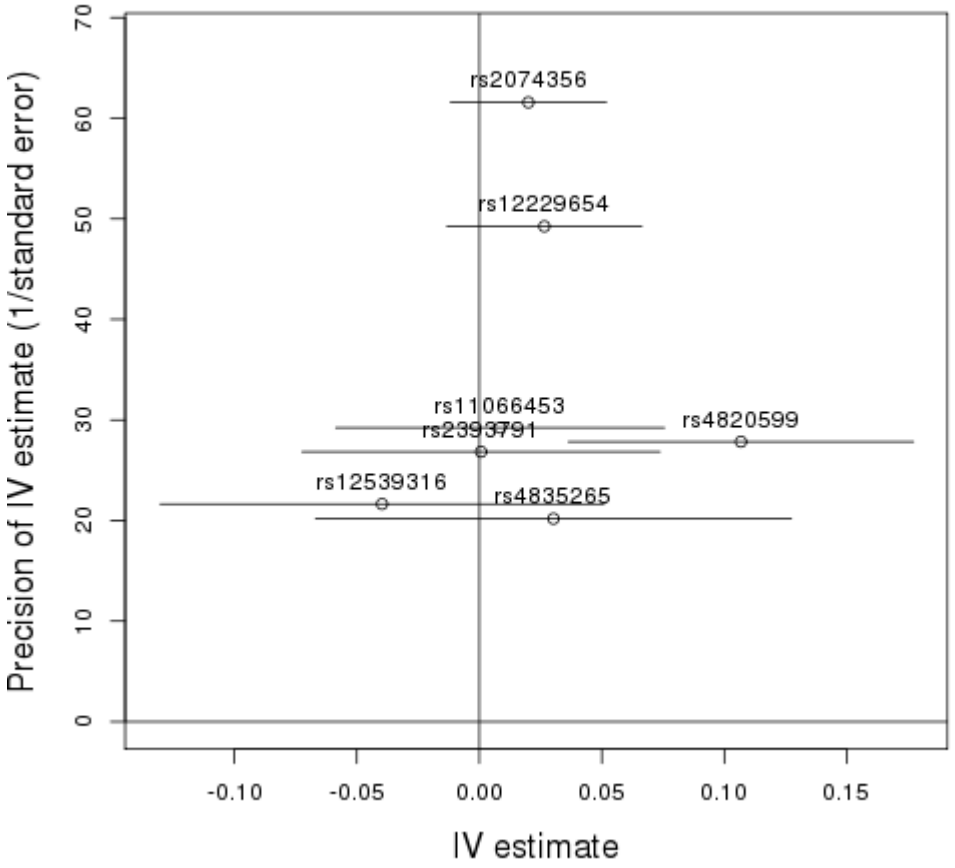
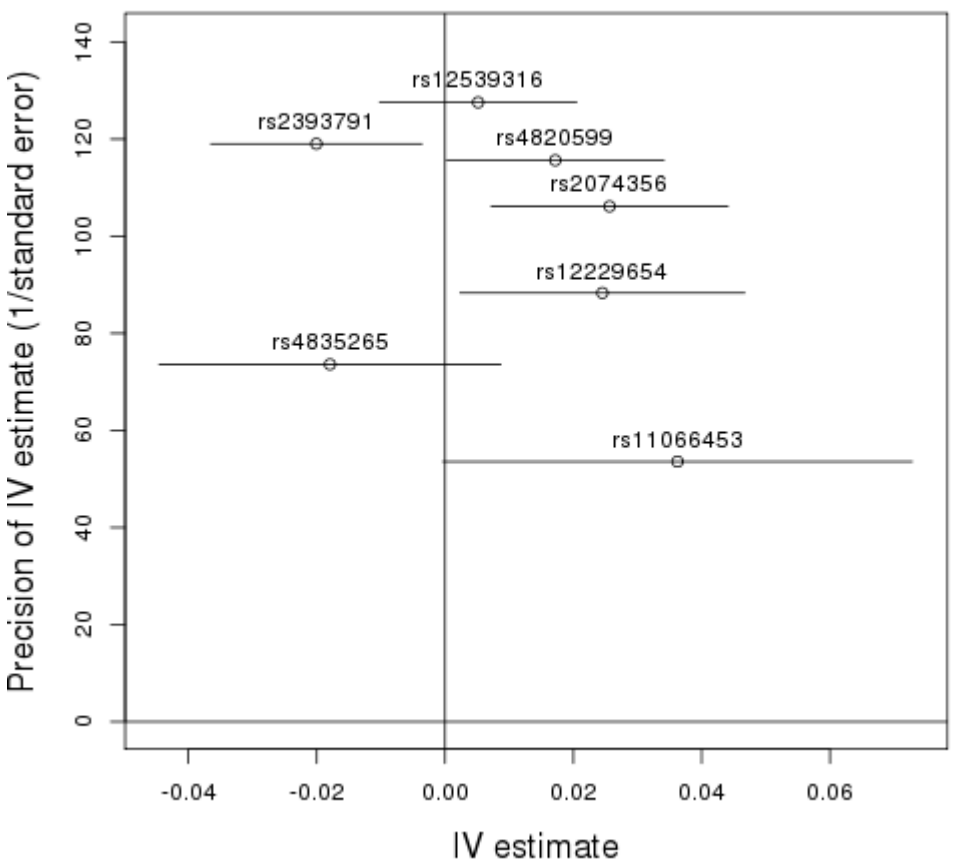
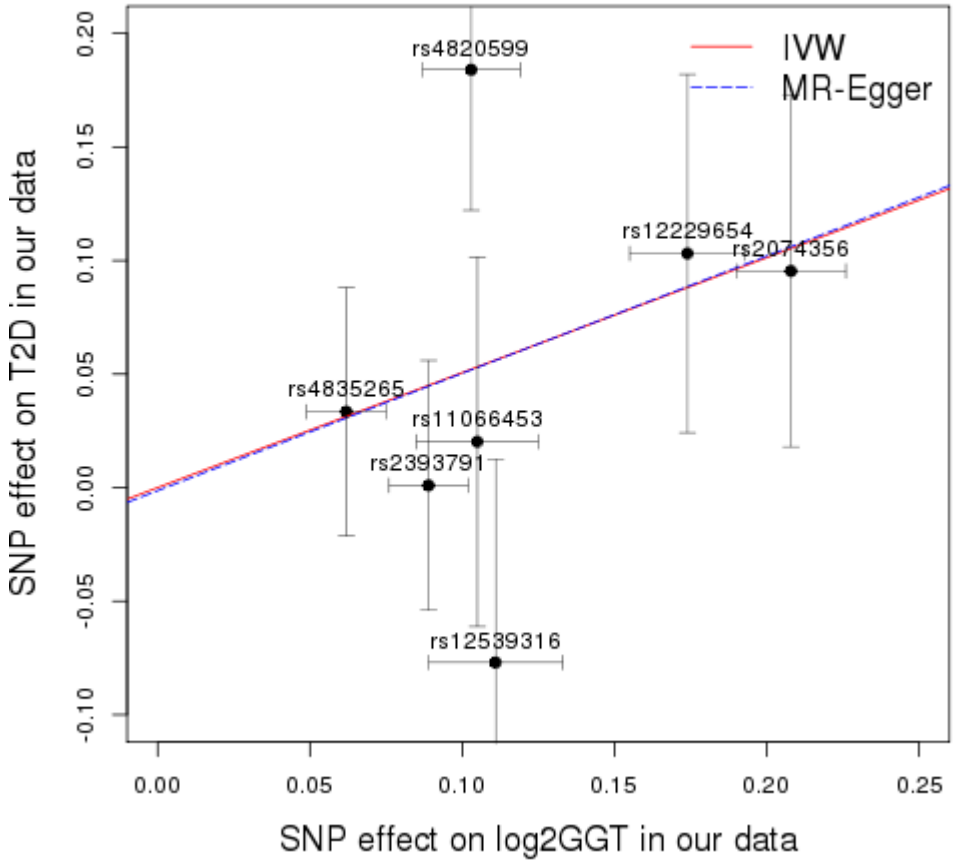
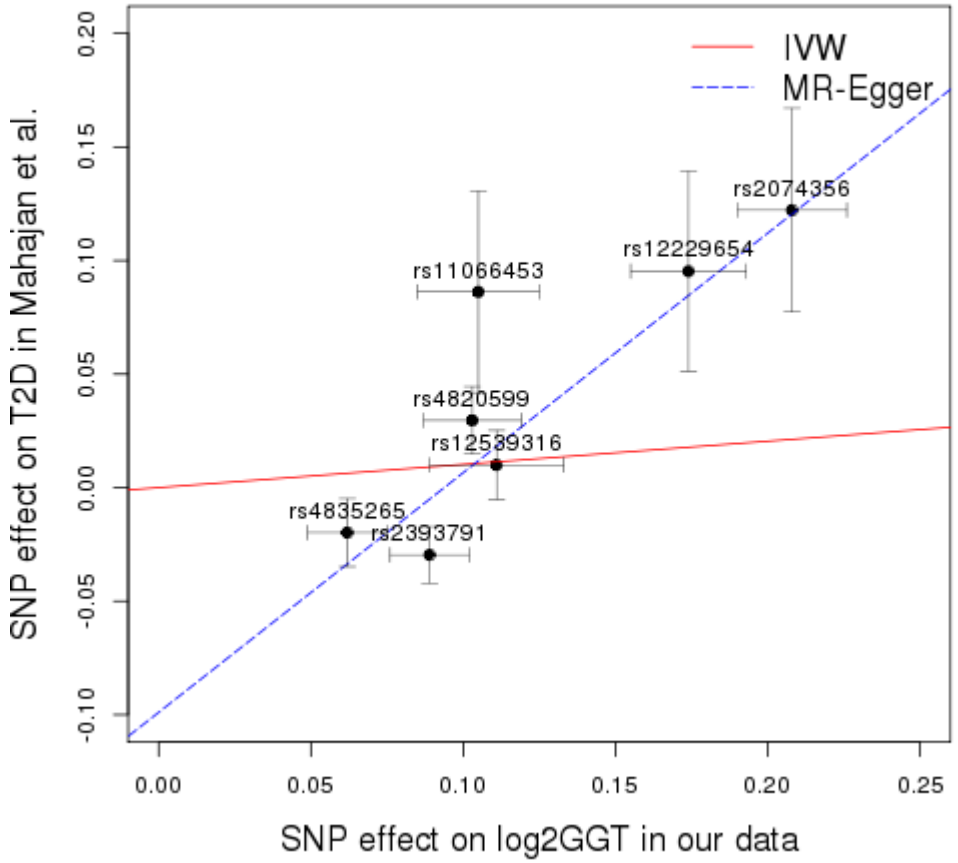
Supplementary Figure S1 Multiple IV analyses: Funnel plots of precision of IV estimates against IV estimates of GGT on type 2 diabetes risk based on each of 7 SNPs that were used as instruments, in the Korean data (left) and under a two-sample approach (right)



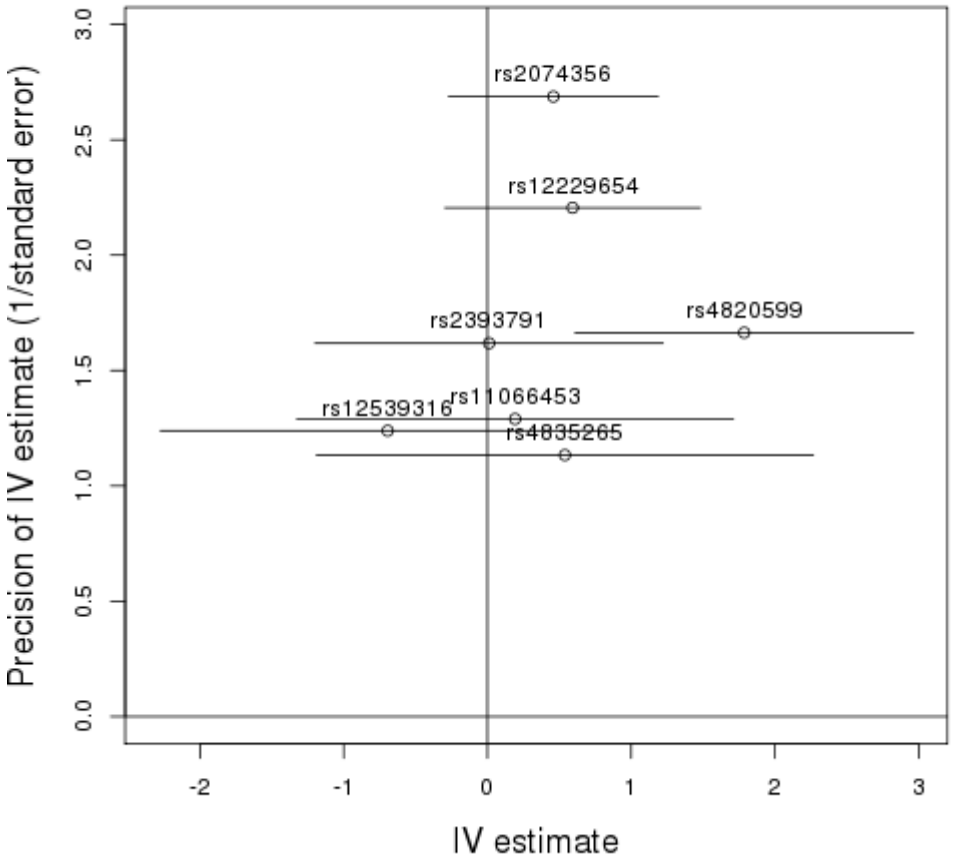


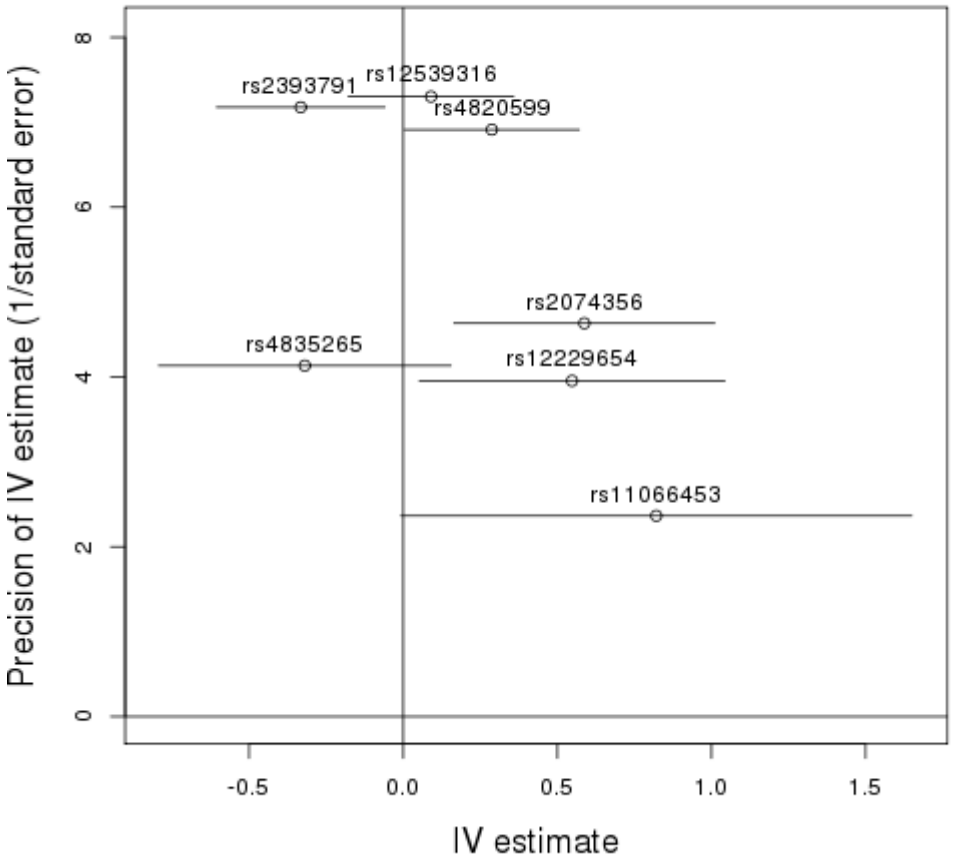
Supplementary Figure S2 Multiple IV analyses: Inverse-variance weighted estimates and MR-Egger estimates of log2-transformed GGT to type 2 diabetes risk with 7 SNPs as instruments, in the Korean data (left) and under a two-sample approach (right)





Supplementary Figure S3 Multiple IV analyses: Funnel plots of precision of IV estimates against IV estimates of log2-transformed GGT on type 2 diabetes risk based on each of 7 SNPs that were used as instruments, in the Korean data (left) and under a two-sample approach (right)





Supplementary Table S1 Genetic variants associated with GGT levels in two large GWAS studies

Nearest gene	SNP	Chr	Position	EA/OA	EAF	Effect* (SE or CI)	P value	N	Reference	Our data				
										G/I/N	EA/OA	EAF	Effect** (SE)	P value
RSG1, EPHA2	rs1497406	1	16,377,907	G/A	0.56	3.8 (2.7–4.8)	$2.8x10^{-19}$	57,592	Chambers et al.	N				
CCBL2, PKN2	rs12145922	1	88,918,822	A/C	0.61	2.8 (2.2–3.4)	$3.8 x10^{-11}$	57,603	Chambers et al.	I	A/C	0.54	0.290 (0.301)	0.335
CEPT1, DENND2D	rs1335645	1	111,485,799	A/G	0.88	4.3 (3.5–5.2)	$7.3 x10^{-9}$	57,649	Chambers et al.	I	A/G	0.83	0.766 (0.398)	0.055
DPM3, EFNA1, PKLR	rs10908458	1	153,393,572	T/C	0.58	3.7 (3.1–4.2)	$1.7 x10^{-15}$	57,602	Chambers et al.	I	T/C	0.13	-0.149 (0.442)	0.736
C2orf16, GCKR	rs1260326	2	27,584,444	T/C	0.38	3.2 (2.4–4.0)	$3.9 x10^{-13}$	57,623	Chambers et al.	N				
MYO1B, STAT4	rs13030978	2	191,825,483	T/C	0.32	3.7 (2.8–4.6)	$1.1 x10^{-11}$	57,247	Chambers et al.	N				
EFHD1, LOC100129166	rs2140773	2	233,221,419	A/C	0.61	2.9 (2.3–3.5)	$1.1 x10^{-9}$	57,604	Chambers et al.	N				
SLC2A2	rs10513686	3	172,208,236	A/G	0.14	4.9 (4.0–5.7)	$6.1 x10^{-11}$	56,686	Chambers et al.	N				
ZNF827	rs4547811	4	147,014,071	C/T	0.18	6.4 (5.0–7.9)	$2.5 x10^{-27}$	57,567	Chambers et al.	I	C/T	0.43	1.118 (0.301)	$2.1x10^{-4}$
	rs4835265	4	147,040,860	A/C	0.42	-0.0043(0.0006)	$1.01 x 10^{-14}$	24,377	Kim et al.	G	T/G	0.43	1.104 (0.301)	$3.1x10^{-6}$
CDH6	rs6888304	5	31,056,278	A/G	0.74	2.7 (2.0–3.5)	$1.2 x10^{-9}$	56,636	Chambers et al.	N				
ITGA1	rs4074793	5	52,228,882	G/A	0.07	5.5 (3.3–7.7)	$3.4 x10^{-10}$	54,935	Chambers et al.	I	G/A	0.06	0.727 (0.611)	0.234
MLIP	rs9296736	6	54,032,656	T/C	0.31	3.0 (2.1–4.0)	$2.6 x10^{-9}$	57,554	Chambers et al.	G	G/A	0.52	0.080 (0.300)	0.789
MLXIP	rs17145750	7	72,664,314	C/T	0.86	4.5 (2.9–6.3)	$2.9 x10^{-9}$	57,175	Chambers et al.	N				
TBL2	rs12539316	7	72,615,834	C/T	0.10	0.0051 (0.0008)	$5.81x10^{-10}$	28,367	Kim et al.	G	C/T	0.10	-1.939 (0.501)	$1.1x10^{-4}$
DLG5	rs754466	10	79,350,440	T/A	0.24	3.5 (2.2–4.8)	$6.4 x10^{-10}$	57,343	Chambers et al.	N				
HNF1A	rs7310409	12	119,909,244	G/A	0.59	6.8 (5.7–7.8)	$7.0 x10^{-45}$	57,452	Chambers et al.	I	G/A	0.52	1.460 (0.302)	$1.4x10^{-6}$
	rs2393791	12	120,986,153	G/A	0.48	0.0076 (0.0007)	$5.75 x10^{-30}$	28,367	Kim et al.	G	G/A	0.48	-1.476 (0.302)	$1.1x10^{-6}$
MYL2	rs12229654	12	109,898,844	G/T	0.14	0.0119 (0.0007)	$8.76 x 10^{-58}$	24,290	Kim et al.	G	G/T	0.15	-3.886 (0.421)	$2.7x10^{-20}$
C12orf51	rs2074356	12	111,129,784	T/C	0.15	0.0161 (0.0007)	$2.88 x 10^{-126}$	28,312	Kim et al.	G	T/C	0.15	-4.766 (0.413)	$8.3x10^{-31}$
OAS1	rs11066453	12	111,850,004	G/A	0.13	0.0097 (0.0007)	$6.27 x 10^{-44}$	28,286	Kim et al.	G	G/A	0.13	-2.379 (0.445)	$9.1x10^{-8}$
C14orf73	rs944002	14	103,106,478	G/A	0.21	6.3 (4.9-7.7)	$5.8 x10^{-29}$	52,414	Chambers et al.	N				
RORA	rs339969	15	58,670,573	A/C	0.62	4.5 (3.9–5.1)	$6.6 x10^{-20}$	57,552	Chambers et al.	N				
CD276	rs8038465	15	71,765,390	T/C	0.39	2.4 (1.8–3.0)	$1.4 x10^{-9}$	57,627	Chambers et al.	N				
DYNLRB2	rs4581712	16	79,055,102	A/C	0.27	3.2 (2.5–3.9)	$3.1 x10^{-9}$	56,906	Chambers et al.	G	A/C	0.39	0.575 (0.308)	0.062
FLJ37644, SOX9	rs9913711	17	67,609,756	C/G	0.65	2.4 (1.8–3.0)	$1.3 x10^{-9}$	57,511	Chambers et al.	N				
ATP8B1	rs12968116	18	53,473,500	C/T	0.87	4.8 (2.8–6.7)	$8.9 x10^{-10}$	48,901	Chambers et al.	N				
NEDD4L	rs4503880	18	54,235,034	T/C	0.21	3.6 (2.5–4.7)	$3.0 x10^{-12}$	48,078	Chambers et al.	N				
FUT2	rs516246	19	53,897,984	T/C	0.47	2.3 (1.8–2.9)	$7.6 x10^{-10}$	53,006	Chambers et al.	N				
MICAL3	rs1076540	22	16,819,958	C/T	0.78	4.8 (3.5–6.1)	$9.6 x10^{-17}$	57,657	Chambers et al.	N				
DDT, DDTL, GSTT1, GSTT2B, MIF	rs2739330	22	22,625,286	T/C	0.42	3.7 (2.7–4.6)	$1.7 x10^{-9}$	48,783	Chambers et al.	N				
GGT1, GGTLC2	rs2073398	22	23,329,104	G/C	0.34	12.3 (10.9–13.7)	$1.1 x10^{-109}$	56,216	Chambers et al.	N				
	rs4820599	22	24,594,246	G/A	0.24	-0.0088 (0.0006)	$7.07 x10^{-53}$	28,365	Kim et al.	G	G/A	0.24	1.723 (0.351)	$8.8x10^{-7}$

*Change of log10-transformed GGT levels (log10(IU/L), for findings from Chambers et al.) or inverse-square–root-transformed GGT levels ((IU/L)^-0.5, for findings from Kim et al.) per an effect allele. **Change of untransformed GGT levels (IU/L) per an effect allele.

EA/OA, Effect allele / Other allele; EAF, Effect allele frequency; SE, Standard error; CI, Confidence interval; G/I/N, Genotyped / Imputed / Not available.

Supplementary Table S2 Observational association: Ordinary least squares estimates of log2-transformed GGT to type 2 diabetes risk

		Type 2 diabetes (n=6,881 for control, 759 for case)	
		OR (95% CI) by OLS estimation	P value
Log2GGT (log2(IU/L))	Unadjusted	1.75 (1.63, 1.89)	**<0.001**
	Model [a]	1.93 (1.77, 2.11)	**<0.001**
	Model [b]	1.90 (1.73, 2.08)	**<0.001**
	Model [c]	1.71 (1.55, 1.90)	**<0.001**

Model [a] was adjusted for age, area, and sex. Model [b] was adjusted for age, area, sex, alcohol use, smoking status, physical activity, and BMI. Model [c] was adjusted for age, area, sex, alcohol use, smoking status, physical activity, BMI, TC, log10-transformed TG, and HDL.

Supplementary Table S3 Instrument-exposure association: Ordinary least squares estimates of rs4820599_G to GGT

		GGT (IU/L) (n=7,640)			
		Effect (SE)	F-statistic	R-squared	P value
rs4820599_G	Unadjusted	1.609 (0.392)	16.87	0.22%	**<0.001**
	Model [a]	1.723 (0.351)	-	-	**<0.001**

Model [a] was adjusted for age, area, and sex.

Supplementary Table S4 Instrument-outcome association: Ordinary least squares estimates of rs4820599_G (as a proxy for GGT) to type 2 diabetes risk

		Type 2 diabetes (n=6,881 for control, 759 for case)	
		OR (95% CI) by OLS estimation	P value
rs4820599_G	Unadjusted	1.19 (1.06, 1.34)	**0.004**
	Model [a]	1.20 (1.06, 1.36)	**0.003**

Mode l [a] was adjusted for age, area, and sex.

Supplementary Table S5 Instrument-exposure association: Ordinary least squares estimates of rs4820599_G to log2-transformed GGT

		Log2GGT (log2(IU/L)) (n=7,640)			
		Effect (SE)	F-statistic	R-squared	P value
rs4820599_G	Unadjusted	0.096 (0.018)	27.70	0.36%	**<0.001**
	Model [a]	0.103 (0.016)	-	-	**<0.001**

Model [a] was adjusted for age, area, and sex.

Supplementary Table S6 Single IV analysis in the Korean data: Two stage least squares estimates of log2-transformed GGT to type 2 diabetes risk using rs4820599_G as an instrument

		Type 2 diabetes (n=6,881 for control, 759 for case)	
		OR (95% CI) by single IV estimation	P value
Log2GGT (log2(IU/L))	2SLS	5.988 (1.84, 19.51)	**0.003**

2SLS was adjusted for age, area, and sex.

Supplementary Table S7 7 SNPs for GGT reported in Kim et al. and their effects on GGT and diabetes risk in the Korean data and in a trans-ethnic GWAS by Mahajan et al.

		GWAS by Kim et al. 2011			Korean data									Trans-ethnic GWAS by Mahajan et al. 2014		
			GGT ((IU/L)^-0.5)) (n≤28,367)			GGT ((IU/L) ^-0.5)) (n=7,640)		GGT (IU/L) (n=7,640)		GGT (log2(IU/L)) (n=7,640)		Diabetes (n=6,881 for control, 759 for case)			Diabetes (n=83,964 for control, 26,488 for case)	
SNP	Nearest Gene	EA/OA	Effect	SE	EA/OA	Effect*	SE	Effect*	SE	Effect*	SE	Effect*	SE	EA/OA	Effect	SE
rs4835265	*ZNF827*	A/C	-0.0043	0.0006	T/G	-0.0048	0.0010	1.104	0.301	0.062	0.013	0.0334	0.0547	A/C	-0.0198	0.0150
rs12539316	*TBL2*	C/T	0.0051	0.0008	C/T	0.0088	0.0016	-1.939	0.501	-0.111	0.022	0.0770	0.0896	G/A	-0.0100	0.0152
rs2393791	*HNF1A*	G/A	0.0076	0.0007	G/A	0.0071	0.0010	-1.476	0.302	-0.089	0.013	-0.0010	0.0550	C/T	0.0296	0.0124
rs12229654	*MYL2*	G/T	0.0119	0.0007	G/T	0.0117	0.0014	-3.886	0.421	-0.174	0.019	-0.1031	0.0789	G/T	-0.0953	0.0440
rs2074356	*C12orf51*	T/C	0.0161	0.0007	T/C	0.0139	0.0013	-4.766	0.413	-0.208	0.018	-0.0954	0.0774	A/G	-0.1222	0.0449
rs11066453	*OAS1*	G/A	0.0097	0.0007	G/A	0.0068	0.0015	-2.379	0.445	-0.105	0.02	-0.0202	0.0814	G/A	-0.0862	0.0444
rs4820599	*GGT1, GGTLC2*	G/A	-0.0088	0.0006	G/A	-0.0079	0.0011	1.723	0.351	0.103	0.016	0.1840	0.0619	G/A	0.0296	0.0149

*SNP effects were estimated after adjustments for age, sex and area.
EA/OA, Effect allele / Other allele; EAF, Effect allele frequency; SE, Standard error.

Supplementary Table S8 Potential pleiotropic effects of 7 SNPs utilized as instruments for GGT in multiple IV analyses, based on published association studies searched through www.phenoscanner.medschl.cam.ac.uk

SNP		Trait	PMID	P-value
rs4835265 (*ZNF827*)	GGT	Gamma glutamyl transpeptidase	21909109	1.00E-14
	Others	Diabetic retinopathy in Type 2 diabetes mellitus	23562823	0.000416
		Pancreatic cancer	20101243	0.002982
		Advanced agerelated macular degeneration geographic atrophy	23455636	0.005039
		Height	25282103	0.013
		Refractive error	23474815	0.0138
		Hip bone mineral density BMD	18445777	0.013845
		Cigarettes per day	20418890	0.03129
		Rheumatoid arthritis	18668548	0.04211
		Spine bone mineral density BMD	18445777	0.046341
rs12539316 (*TBL2*)	GGT	Gamma glutamyl transpeptidase	21909109	6.00E-10
	Others	Triglycerides	20686565	8.11E-38
		Triglycerides	24097068	7.99E-37
		Triglycerides	23063622	9.15E-25
		Serum VLDLD	22286219	2.99E-11
		Serum MVLDLTG	22286219	3.47E-11
		Serum urate	23263486	5.95E-09
		Triglycerides	19060906	7.71E-08
		Gene expression of PTGS2 in peripheral blood monocytes	20502693	5.75E-06
		Triglycerides	19913121	9.39E-06
		Height	18391952	1.40E-05
		Height	25282103	2.30E-05
		Triglycerides change with statins	20339536	4.80E-05
		Total cholesterol	20339536	0.000117
		Birthweight	23202124	0.00099
		Height	23754948	0.001043
		Height	20881960	0.002571
		HDL	20686565	0.002914
		HDL	24097068	0.004306
		Maternal transmission distortion	22377632	0.004474
		Cystatin C in serum	20383146	0.0046
		Crohns disease	23128233	0.0058
		Advanced agerelated macular degeneration geographic atrophy	23455636	0.005954
		Height females	23754948	0.0066
		Serum creatinine	20383146	0.0069
		LDL cholesterol change with statins	20339536	0.010007
		log(Ins30) adjusted for BMI	24699409	0.010334
		log(eGFR cystatin C)	20383146	0.012
		log(CIR)	24699409	0.012426
		Total cholesterol change with statins	20339536	0.015885
		Gene expression of BAZ1B probe 208445sat in prefrontal cortex	20351726	0.0169
		Hip	25673412	0.02
		log(Ins30)	24699409	0.021094
		log(DI)	24699409	0.024823
		Mitral annular calcium	23388002	0.03296
		log(eGFR creatinine)	20383146	0.038
		Transmission distortion	22377632	0.03947
		Total cholesterol	24097068	0.04024
		Hip males	25673412	0.041
		log(AUCins/AUCglu)	24699409	0.041294
		Total cholesterol	20686565	0.04435
		log(CIR) adjusted for ISI	24699409	0.048805
rs2393791 (*HNF1A*)	GGT	Gamma glutamyl transpeptidase	21909109	7.00E-30
		Serum gammaglutamyl transferase GGT activity in adults	22010049	2.20E-10
		Gammaglutamyl transferase GGT	18940312	7.58E-10
		Serum gammaglutamyl transferase GGT activity in adolescents	22010049	8.50E-06
		Gammaglutamyl transpeptidase cGTP	22788528	0.00504
	Diabetes	Type II diabetes	26551672	0.013
		Type II diabetes	24509480	0.032
	Others	LDL	24097068	2.74E-14
		Total cholesterol	24097068	9.67E-13

		LDL	20686565	8.46E-11
		Total cholesterol	20686565	1.61E-10
		Creactive protein levels	24763700	3.00E-10
		Creactive protein and white blood cell count	22788528	3.00E-09
		Creactive protein CRP	22788528	3.40E-09
		LDL cholesterol	19060906	1.47E-06
		CHD	21378990	9.98E-06
		Coronary artery disease CAD	23202125	9.98E-06
		CHD	26343387	9.95E-05
		MI	26343387	0.000113
		HDL	24097068	0.000717
		HDL	20686565	0.006985
		Ulcerative colitis	23128233	0.00701
		log(eGFR cystatin C)	20383146	0.01
		log(Proinsulin)	21873549	0.01409
		Waist hip ratio	25673412	0.016
		Degenerative arthritis	22788528	0.0172
		log(CIR)	24699409	0.022528
		Urine pH	22788528	0.0239
		log(DI)	24699409	0.026932
		Chloride	22788528	0.0283
		Tuberculosis	22788528	0.0292
		HDL cholesterol	20339536	0.030511
		Cystatin C in serum	20383146	0.033
		Height	25282103	0.035
		LpPLA2 activity	20442857	0.0351
		log(Ins30) adjusted for BMI	24699409	0.043295
		Calcium	22788528	0.0442
		log(HOMA-B)	20081858	0.0455
		HOMAB	20081858	0.0455
		Folate	22788528	0.0468
rs12229654 (*MYL2)*	GGT	Gamma glutamyl transpeptidase	21909109	9.00E-58
	Diabetes	Type II diabetes	24509480	0.033
	Others	Alcohol ever vs never	23555315	3.09E-53
		Alcohol consumption male	21270382	8.30E-41
		Alcohol consumption	23364009	3.79E-35
		Alcohol consumption	21270382	4.00E-35
		HDL cholesterol	21909109	3.00E-23
		Esophageal squamous cell carcinoma Esophageal cancer	20833657	3.30E-18
		1hour glucose tolerance test	23575436	8.83E-13
		Esophageal squamous cell carcinoma Esophageal cancer	21642993	4.07E-09
		Body mass index	24861553	5.00E-09
		Alcohol	23555315	1.36E-06
		Metabolic syndrome	25705158	3.00E-06
		Rheumatoid arthritis Asians	24390342	0.0037
		Rheumatoid arthritis Trans Ethnic	24390342	0.0043
rs2074356 (*C12orf51)*	GGT	Gamma glutamyl transpeptidase	21909109	3.00E-126
	Diabetes	Type II diabetes	24509480	0.0056
		Gestational diabetes mellitus	23575436	0.026
	Others	Alcohol ever vs never	23555315	1.19E-75
		Alcohol consumption male	21270382	2.45E-63
		Esophageal squamouscell carcinoma in smokers and drinkers Esophageal cancer	21642993	5.47E-62
		Alcohol Drinking	21270382	9.00E-59
		Alcohol consumption	23364009	9.49E-59
		Esophageal squamouscell carcinoma in smokers Esophageal cancer	21642993	3.44E-55
		Esophageal squamouscell carcinoma in drinkers Esophageal cancer	21642993	3.60E-45
		HDL cholesterol	21909109	6.95E-37
		Esophageal squamous cell carcinoma Esophageal cancer	21642993	2.44E-31
		Esophageal squamous cell carcinoma Esophageal cancer	20833657	3.90E-21
		Coronary artery disease CAD	21971053	3.40E-18
		1hour glucose tolerance test	23575436	1.04E-16
		HDL cholesterol	21572416	9.40E-15
		Coronary artery disease CAD	21572416	1.10E-14
		Fasting blood glucose	23575436	6.03E-14
		LDL cholesterol	21572416	6.50E-12
		Waist hip ratio	19396169	7.80E-12
		Esophageal squamouscell carcinoma in nonsmokers Esophageal cancer	21642993	2.02E-11

		Coronary artery disease CAD	23364394	6.73E-11
		Blood urea nitrogen	22797727	1.80E-09
		Serum creatinine	22797727	1.90E-09
		Renal functionrelated traits BUN	22797727	2.00E-09
		2hour glucose tolerance test	23575436	5.91E-09
		Diastolic blood pressure DBP	21572416	6.00E-09
		Systolic blood pressure SBP	21572416	1.50E-08
		Alcohol	23555315	6.42E-08
		Serum creatinine estimated glomerular filtration rate eGFR	22797727	6.50E-08
		Esophageal squamouscell carcinoma in nonsmokers and nondrinkers Esophageal cancer	21642993	3.58E-06
		Esophageal squamouscell carcinoma in nondrinkers Esophageal cancer	21642993	1.09E-05
		Uric acid in serum	22797727	1.60E-05
		HDL cholesterol adjusted for alcohol intake	21572416	0.00026
		Fasting blood glucose	21572416	5.00E-04
		LDL cholesterol adjusted for alcohol intake	21572416	0.001
		Alcohol Use Disorder Identification Test higher scores male	21270382	0.00117
		Total cholesterol	21572416	0.027
		Body mass index BMI adjusted for alcohol intake	21572416	0.032
		Fasting blood glucose adjusted for alcohol intake	21572416	0.046
rs11066453 (*OAS1)*	GGT	Gamma glutamyl transpeptidase	21909109	6.00E-44
	Diabetes	Gestational diabetes mellitus	23575436	0.027
	Others	Alcohol consumption male	21270382	1.77E-20
		1hour glucose tolerance test	23575436	4.54E-09
rs4820599 (*GGT1, GGTLC2)*	GGT	Gamma glutamyl transpeptidase	21909109	7.00E-53
		Gammaglutamyl transferase GGT	20139978	6.82E-22
		Serum gammaglutamyl transferase GGT activity in adults	22010049	2.50E-11
		Gammaglutamyl transferase GGT	18940312	3.98E-11
		Gammaglutamyl transferase GGT	20676096	3.90E-06
		Serum gammaglutamyl transferase GGT activity in adolescents	22010049	1.40E-05
	Diabetes	Type II diabetes	24509480	0.04
	Others	Alkaline Phosphatase	18940312	4.00E-11
		Liver enzyme levels	18940312	4.00E-11
		Gene expression of GGT1 in normal prepouch ileum	23474282	2.12E-10
		Gene expression of GGT3P in normal prepouch ileum	23474282	5.19E-09
		Gene expression of AP0003544GGT1 in blood	21829388	0.00024
		Height variability	22982992	0.0018
		Pancreatic cancer	20484958	0.003
		Primary sclerosing cholangitis	22521342	0.0038
		Bipolar disorder	22182935	0.005061
		log(DI)	24699409	0.035541
		Cross disorder	23453885	0.04672

Supplementary Table S9 Multiple IV analysis in the Korean data: Two stage least squares estimates, inverse-variance weighted estimates and MR-Egger estimates of log2-transformed GGT to type 2 diabetes risk with 7 SNPs as instruments

		Type 2 diabetes (n=6,881 for control, 759 for case)			
		Intercept Estimate (SE, P value)	Slope Estimate (SE, P value)	OR (95% CI) by multiple IV estimation	P value
Log2GGT (log2(IU/L))	2SLS	-	-	1.704 (1.035, 2.808)	**0.036**
	IVW	Constrained to 0	0.506 (0.240, P=0.035)	1.660 (1.036, 2.655)	**0.035**
	MR-Egger	-0.001 (0.083, P=0.988)	0.517 (0.690, P=0.488)	1.677 (0.284, 9.887)	0.488

2SLS was adjusted for age, area, and sex. 7 SNP effects on log2GGT and type 2 diabetes, used in IVW and MR-Egger, were reported in Supplementary Table S7.

Supplementary Table S10 Multiple IV analysis under a two-sample approach: Inverse-variance weighted estimates and MR-Egger estimates of log2-transformed GGT to type 2 diabetes risk with 7 SNPs as instruments

		Type 2 diabetes (under a two-sample approach*)			
		Intercept Estimate (SE, P value)	Slope Estimate (SE, P value)	OR (95% CI) by multiple IV estimation	P value
Log2GGT (log2(IU/L))	IVW	Constrained to 0	0.102 (0.141, P=0.469)	1.108 (0.840, 1.460)	0.469
	MR-Egger	-0.099 (0.035, **P=0.036**)	1.055 (0.347, P=0.029)	2.873 (1.176, 7.017)	**0.029**

7 SNP effects on log2GGT and type 2 diabetes, used in IVW and MR-Egger, were reported in Supplementary Table S7. *SNP effects on GGT were estimated in the Korean data (n=7,640) and SNP effects on type 2 diabetes risk were estimated in a trans-ethnic GWAS (n≤83,964 for control, 26,488 for case).